

Paper Calculating Slide Rule

METRIC UNITS

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paper
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PAPER CALCULATING SLIDE RULE

METRIC UNITS

| OPERATING INSTRUCTIONS

This duplex paper calculating slide rule in metric units has been specially produced by *Paper Facts & Figures* to enable paper buyers, estimators and others involved in the use and distribution of paper to carry out the numerous calculations required following the introduction of the metric system into the paper and printing industries. It is extremely accurate and easy to use and the special scales and index points are arranged so that standards, constants and equivalents can be located quickly and positively.

The paper sizes shown on the rule are the metric ISO A, RA and SRA series given in BS4000:1968. Other series which may later be adopted can be added to the rule merely by setting up the size in millimetres on scales CD and making an appropriate mark on Scale G beneath the area index on the slide. Marks should be cut neatly into the rule with a sharp instrument, the cut being filled with lead from a pencil in order to show clearly.

The various functions of the rule are quite straight forward but, like most versatile instruments, it is necessary to follow the correct procedure. Learn to use it confidently and it will save you endless time and remove much of the tedium from paper calculations. The rule is manufactured to the highest standards from selected materials and is robust, stable, non-flammable and resistant to mould and moisture, but to obtain the maximum life from it, there are certain recommendations on care and handling and you are advised to read the notes on page 7.

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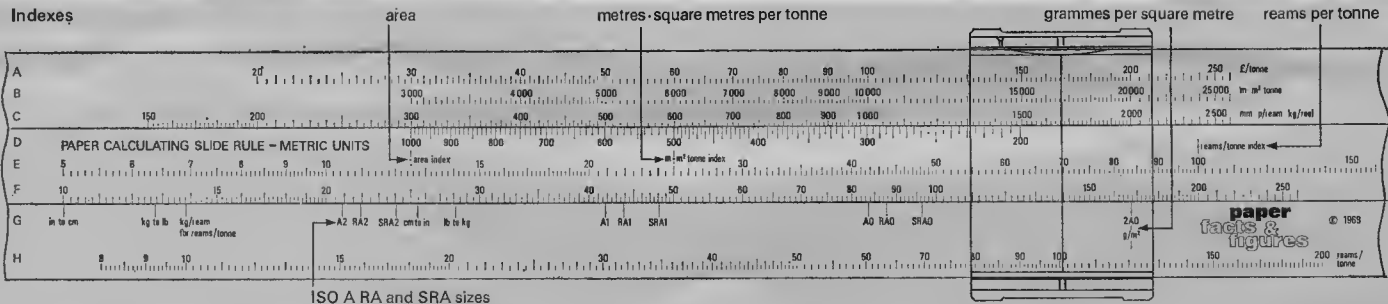
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SCALES FOR PAPER CALCULATIONS

A £'s per tonne

B metres · square metres per tonne

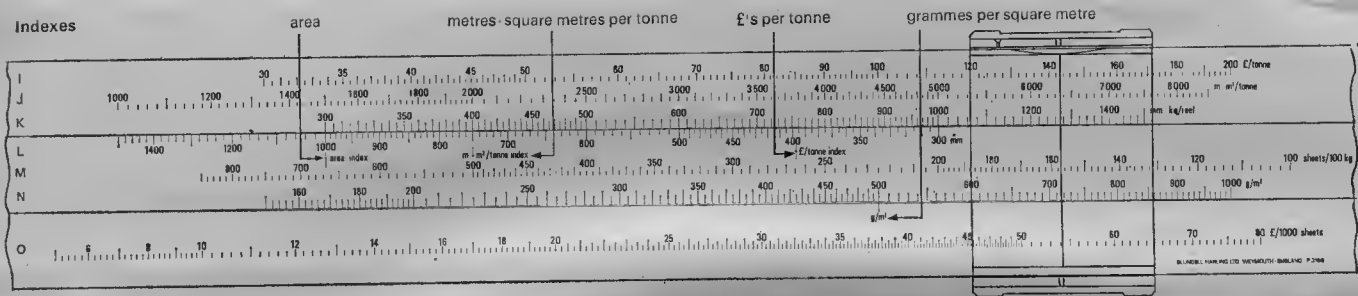
C millimetres · new pence per ream · kilograms per reel

D millimetres

E & F grammes per square metre · kilograms per ream

G ISO sheet sizes · size and weight conversion

H reams per tonne



SCALES FOR BOARD CALCULATIONS

I £'s per tonne

J metres square metres per tonne

K millimetres kilograms per reel

L millimetres

M Sheets per 100 kilogram

N grammes per square metre

O £'s per 1000 sheets

Care of the calculator

The calculator is a precision instrument but is nevertheless robust and capable of withstanding a great deal of hard use. However, in the interests of the user and to make certain that it retains its high standard of accuracy throughout its life, these recommendations should be followed:

Keep it in its case when not in use.

Avoid handling with soiled or chemically stained fingers.

Do not expose it to extremes of temperature and particularly avoid leaving it for any length of time in direct sunlight.

On no account should the scales or cursor be cleaned with an abrasive compound. A light rub from time to time to remove dust is usually adequate but, if necessary, a cleaning paste (obtainable at drawing office suppliers) may be used.

Inches to centimetres

Method. Set inch dimension on scale F opposite in to cm index on scale G. Read answer on scale F opposite cm to in index on same scale.

Example. What is 20in in cm?

Answer. 50·8 cm.

Pounds weight to kilogrammes

Method. Set lb weight on scale F at lb to kg index on scale G. Read answer on scale F opposite kg to lb index on scale G.

Example. What is 30 lb in kg?

Answer. 13·6 kg.

page 8

Ream weight given grammage and size

Method. Set required size on scales CD. Place cursor over area index on slide. Set grammage on scale F to g/m^2 index on scale G. Read off weight per ream (500's) in kg on scale F at cursor.

Example. What is ream weight in size 700 x 900 mm basis weight 100 g/m^2 ?

Answer. 31·5 kg per ream.

Grammage given ream weight in kg and size in mm

Method. Set given size on scales CD. Set cursor over area index on slide. Set given ream weight in kg on scale F below cursor. Read off answer on scale F opposite g/m^2 index on scale G.

Example. What is the grammage of a paper which weighs 19·1 kg per ream 600 x 850 mm?

Answer. 75 g/m^2 .

page 9

Ream weight in required size from given size

Method. Set required size on scales CD. Place cursor over ream weight of the given size on scale F. Set given size on scales CD and read answer on scale F at cursor.

Example. What is the ream weight in 400 x 750 mm size for paper weighing 21 kg per ream 500 x 700 mm?

Set 400 x 750 on scales CD and adjust cursor to 21 on scale F. Set 500 x 700 on scales CD.

Answer. 18 kg appears on scale F at cursor and is the ream weight in 400 x 750 mm.

page 10

Yield in square metres per tonne given grammage

Method. Set grammage on scale F opposite g/m² index on scale G. Using cursor read off answer on scale B opposite m²/tonne index on slide.

Example. What is the yield in square metres per tonne for a paper of 100 g/m²?

Answer. 10,000 m²/tonne

Yield in reams per tonne, given ream weight in kg

Method. Using cursor set ream weight in kg on scale E opposite kg/ream index mark on scale G. Read off answer on scale H below cursor set to reams/tonne index on slide.

Example. What is the yield in reams per tonne from ream weight of 25 kg?

Answer. 40 reams. Although reams have been used in the example, the weight could refer to any other unit pack, e.g. 1000 sheets of paper or 100 sheets of board.

page 11

Price per lb to price per kg or tonne

Method. Convert price per lb to old pence and using cursor set resultant figure on scale E opposite 100 on scale A. Read off answer on scale E opposite 92 on scale A.

Example. What is $1/3$ per lb in new pence per kilogramme?

Answer. 13·8 p. *Note.* Multiplying answer by 10 gives £'s per tonne.

Price in new pence per kg to price per lb in old pence

Method. Set price in new pence per kg on scale E opposite 92 on scale A. Read answer in old pence per lb on scale E opposite 100 on scale A.

Example. What is 11p per kg in old pence per lb?

Answer. 12 old pence or 1/0 per lb.

Note. To convert price per tonne to price per lb divide price in £'s per tonne by 10 and proceed as above.

page 12

Cost per ream given weight per ream in kg and price per tonne

Method. Using cursor set reams/tonne index on slide below price per tonne on scale A. Read off price per ream in new pence on scale C below cursor set to ream weight on scale E.

Example. Given paper at £90 per tonne and ream weight 35 kg, what is the price per ream?

Answer. 315p or £3·15.

Similarly the cost of any other unit pack can be ascertained if its weight be known.

page 13

Cost per 1000 m² knowing price per tonne and grammage

Method. Using cursor, set reams/tonne index on slide below price per tonne on scale A. Read off cost in new pence per 1000 m² on scale C below cursor set to given grammage on scale E.

Example. Given paper at £85 per tonne and 90 g/m², what is the cost per 1000 m²?

Answer. 765p or £7·65

% uplift or discount from price

Method. Using cursor, set reams/tonne index on slide opposite price per tonne on scale A. Adjust cursor to % uplift or discount on scale E and read answer below cursor on scale A.

Example. Paper costs £120 per tonne, what is the selling price taking 5% profit?

Answer. £126.

page 14

Linear metres on a reel given grammage, total weight of reel in kg and width in mm

Method. Using method given on page 9 first calculate weight per ream of a sheet 1000 mm x width of reel. This gives weight in kg per 500 m. Double this to give weight per 1000 m. Using cursor, set resultant weight on scale E below weight of reel on scale C.

Move cursor to reams/tonne index on slide and read answer on scale B.

Example. Given paper 90 g/m², reel width 750 mm, weight 500 kg, how many metres are there on reel? Weight per ream: 750 x 1000 mm = 33·75 kg. Double to give 67·5 and set this figure on scale E opposite 500 on scale C.

Answer. Read from scale B opposite reams/tonne index on slide, 7410 m.

page 15

Apparent specific gravity of paper given thickness in microns and grammage

Method. First remove slide, invert and replace. Using cursor set grammage on scale F opposite g/m^2 index on scale G. Move cursor to thickness of single sheet in microns on scale A. Read answer on scale E and divide by 100.

Example. What is the apparent specific gravity of a paper of 120 g/m^2 , 160 microns in thickness?

Answer. 0.75.

page 16

Thickness of paper in microns, given grammage and apparent specific gravity

Method. First remove slide, invert and replace. Using cursor set grammage on scale F opposite g/m^2 index on scale G. Multiply apparent specific gravity by 100 and place cursor over resultant figure on scale E. Read off answer as thickness of a single sheet in microns below cursor on scale A.

Example. What is the thickness of a paper of 120 g/m^2 of 0.75 apparent specific gravity?

Answer. 160 microns.

Grammage of paper given thickness in microns and apparent specific gravity

Method. First remove slide, invert and replace. Multiply given apparent specific gravity by 100. Using cursor set resultant figure on scale E opposite thickness in microns on scale A. Move cursor to g/m^2 index on scale G and read answer below cursor on scale F.

Example. What is the grammage of a paper 160 microns of 0.75 apparent specific gravity?

Answer. 120 g/m^2 .

page 17

**Number of reams per reel
given sheet in mm,
grammage, width of reel
in mm and weight in kg**

Method. First calculate nett weight of reel that can be used, i.e. deduct trim.
e.g.: to cut sheets 350 x 570 mm from a reel 800 mm wide weighing 750 kg.

$$2 \times 350 = 700 \text{ therefore usable weight is } \frac{750 \times 7}{8} = 656.25 \text{ kg.}$$

Calculate weight per ream in kg from given size and grammage by method given on page 9.
Set cursor on nett weight of reel that can be used (as above) on scale C. Set ream weight in kg on scale E below cursor. Move cursor to 10 on scale E and read answer on scale A.

Example. How many reams of paper of 120 g/m², size 350 x 570 mm can be cut from a reel 800 mm wide weighing 750 kg? Calculated nett usable weight of reel 656.25 kg (from above). Ream weight is 12 kg.

Set cursor to 656.25 on scale C. Set 12 on scale E below cursor. Move cursor to 10 on scale E.

Answer. Appears on scale A at cursor, 54.7 reams.

page 18

**Thickness of given number
of pages given grammage
and volume basis†**

Method. Using cursor set volume basis on scale E opposite 200 (200pp=100 sheets) on scale C. Move cursor to given number of pages on scale C and read corresponding thickness in mm on scale E. Using cursor, set resultant figure on scale E below 100 on scale A. Move cursor to given grammage on scale A and read answer on scale E.

Example. What is the thickness of 320pp of a paper of 90 g/m² and volume basis 23.25? Set 23.25 on scale E opposite 200 on scale C. Read thickness for 320pp on scale E below 320 on scale C=37.25. Set 37.25 on scale E below 100 on scale A.

Answer. Appears on scale E below 90 on scale A=33.5 mm.

† Volume basis used in metric terms is the thickness of 100 sheets of 100 g/m² expressed in millimetres.

page 19

Grammage required for given thickness in mm of given number of pages of paper of given volume basis

Method. Using cursor set given thickness in mm on scale E opposite given number of pages on scale C. Read thickness for 200pp on scale E below 200 on scale C. Set volume basis on scale E below 100 on scale A. Move cursor to thickness for 200pp on scale E and read grammage at cursor on scale A.

Example. What grammage is required for 400pp of 17·5 volume basis to be 26·25mm thick?

Set 26·25 on scale E opposite 400 on scale C. Thickness corresponding to 200pp is 13·125. Set volume basis on scale E below 100 on scale A.

Answer. Appears on scale A opposite 13·125 on scale E=75 g/m².

page 20

Volume basis of paper for a given thickness in mm for a given grammage and number of pages

Method. Using cursor set given thickness on scale E opposite number of pages on scale C. Move cursor to 200 on scale A and read corresponding thickness on scale E. Using cursor set resultant figure on scale E below given grammage on scale A. Move cursor to 100 on scale A, and read answer on scale E.

Example. What volume basis of paper is required if 360pp of paper of 90 g/m² are to be 35 mm thick?

Set 35 on scale E opposite 360 on scale A. Thickness corresponding to 200pp is 19·4 mm. Set 19·4 on scale E opposite 90 on scale A.

Answer. Appears at cursor on scale E below 100 on scale A=21·5.

page 21

Count* of board given grammage and size in mm

Method. Set required size on scales K L. Adjust cursor to area index on slide. Set grammage on scale N against g/m^2 index mark on scale O. The answer in number of sheets per 100 kg appears below cursor on scale M.

Example. With board of 300 g/m^2 $600 \times 800 \text{ mm}$ in size what is the number of sheets per 100 kg?

Answer. 694 sheets per 100 kg.

page 22

**Expression 'count' denotes number of sheets per 100 kg*

Count* of board in required size from count in given size

Method. Set required size on scales K L and adjust cursor to count of given size on scale M. Set given size on scales K L and read answer on scale M below cursor.

Example. Given board $750 \times 1000 \text{ mm}$ with a count of 400 sheets per 100 kg, what is the count for $600 \times 800 \text{ mm}$? Set 600×800 on scales K L and move cursor to 400 on scale M. Set 750×1000 on scales K L and read answer on scale M.

Answer. 625 sheets per 100 kg in size $600 \times 800 \text{ mm}$.

page 23

**Expression 'count' denotes number of sheets per 100 kg*

Yield in square metres per tonne given grammage

Method. Set grammage on scale N against g/m^2 index on scale O. Move cursor to $\text{m}^2\text{/tonne}$ index on slide and read answer on scale J.

Example. Given a grammage of 400, what is the yield in m^2 per tonne?

Answer. 2500 m^2 per tonne.

Note. Dividing answer by 10 gives count in terms of sheets 1 m^2 per 100 kg.

page 24

Cost per 1000 sheets given count* and price per tonne

Method. Using cursor, set £/tonne index on slide to price per tonne on scale I. Read answer in £'s per 1000 sheets on scale O below cursor set to appropriate count on scale M.

Example. What is the cost per 1000 sheets of board costing £85 per tonne with a count of 400 sheets per 100 kg? Using cursor set £/tonne index to 85 on scale I. Use cursor again to find answer on scale O directly below 400 on scale M.

Answer. £21·25 per 1000 sheets.

Note. If this calculation is based on the count of a sheet one square metre in area, the answer is then the cost per 1000 square metres.

**Expression 'count' denotes number of sheets per 100 kg.*

page 25

Linear metres on a reel of board given

1) count *, width of reel in mm and weight in kg

2) grammage, width of reel in mm, and reel weight in kg

page 26

Method. 1) Using method given on page 25 first calculate count of board in size of 1000 mm x width of reel. Answer is number of linear metres per 100 kg. Using cursor set this count on scale M against weight of reel in kg on scale K. Answer appears on scale J below cursor set to $m \cdot m^2/\text{tonne}$ index on scale M.

Example. How many metres are there on a reel of board 800 mm wide weighing 500 kg and with a count of 320 per m^2 ? The count in 800×1000 mm is 400 sheets. Using cursor, set 400 on scale M below 500 on scale K. Move cursor to $m \cdot m^2/\text{tonne}$ index and read answer on scale J under cursor line.

Answer. 2000 metres.

Method. 2) First calculate count in size 1000 mm x width of reel from grammage and then proceed as above.

**Expression 'count' denotes number of sheets per 100 kg*

Thickness in mils to thickness in microns

page 27

Method. (Thicknesses up to 10 mils). Multiply thickness in mils by 10 and set resultant figure on scale F opposite in to cm index on scale G. Read off answer on scale F opposite cm to in index in scale G.

Example. What is 5 mils in microns?

Answer. 127 microns.

Method. (Thicknesses above 10 mils). Set thickness in mils on scale F opposite in to cm index on scale G. Read off answer on scale F opposite cm to in index on scale G and multiply by 10.

Example. What is 15 mils in microns?

Answer. 381 microns.

Note. 1 mil = 0.001 in.

Thickness in microns to thickness in mils

Method. (Thicknesses up to 250 microns). Set thickness in microns on scale F opposite cm to in index on scale G. Read off answer on scale F opposite in to cm index on scale G and divide by 10.

Example. What is 150 microns in mils?

Answer. 5·9 mils.

Method. (Thicknesses above 250 microns). Divide thickness in microns by 10 and set resultant figure on scale F opposite cm to in index on scale G. Read off answer on scale F opposite in to cm index on scale G.

Example. What is 750 microns in mils?

Answer. 29·5 mils.

Note. 1 micron = 0·001 mm

page 28

Apparent specific gravity of board given thickness in microns and grammage

Method. Using cursor, set figure for grammage on scale M opposite g/m² index on scale O. Move cursor to thickness in microns on scale M. Read off answer on scale 1 and divide by 100.

Example. What is the apparent specific gravity of a board of 500 g/m² and a thickness of 800 microns?

Answer. 0·625.

Note. Alternatively scale L can be used in place of scale M.

page 29

Thickness of board given grammage and apparent specific gravity

Method. Using cursor set grammage on scale M opposite g/m^2 index on scale O. Multiply apparent specific gravity by 100 and move cursor to resultant figure on scale I. Read off answer on scale M.

Example. What is the thickness of a board of 500 g/m^2 of 0.625 apparent specific gravity?

Answer. 800 microns.

Note. Alternatively scale L can be used in place of scale M.

page 30

Grammage of a board given thickness in microns and apparent specific gravity

Method. Multiply apparent specific gravity by 100. Using cursor set thickness in microns on scale M below resultant figure on scale I. Move cursor to g/m^2 index on scale O and read answer on scale M.

Example. What is the grammage of a board 800 microns in thickness, of 0.625 apparent specific gravity?

Answer. 500 g/m^2 .

Note. Alternatively scale L can be used in place of scale M.

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